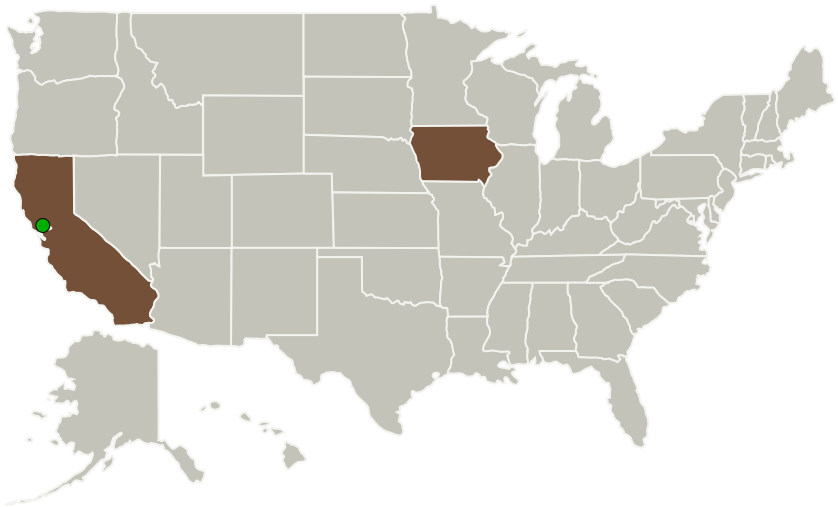
RotCFD: A Viscous Design Tool for Advanced Configurations, Phase II

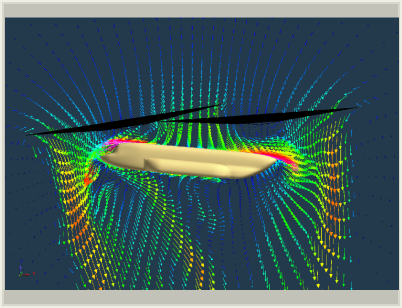
Completed Technology Project (2012 - 2014)

Project Introduction

During initial design studies, parametric variation of vehicle geometry is routine. In addition, rotorcraft engineers traditionally use the wind tunnel to evaluate and finalize designs. Correlation between wind tunnel results and flight tests, when not good, have been often attributed in part to uncertainty in blockage corrections. Estimation of rotor blockage is significantly more complex than bluff body corrections as the correction depends on operational characteristics such as rotor RPM and thrust produced. This proposal offers to develop an Integrated Design Environment (IDE) which can simulate a complete rotorcraft with or without wind tunnel walls including all the facility effects. At the heart of the innovation are: 1. An automated hybrid grid generator. (viscous grids near the bodies and unstructured Cartesian grid everywhere else) 2. A robust and economical incompressible flow solver for the entire system of grids. 3. Momentum source based rotor model that is suitable and economical for simulating configurations with multiple rotors. In Phase I, the proof-of-concept developed used unstructured Cartesian grid for the model and wind tunnel. In phase II, the tool will be extended to hybrid grid with viscous grid near solid surfaces and will include several tools including a simple CAD like geometry manipulation tool and pre- and post-processing tools all integrated in one environment to facilitate ease of use.

Primary U.S. Work Locations and Key Partners





RotCFD: A Viscous Design Tool for Advanced Configurations Project Image

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Organizations Performing Work	Role	Type	Location
Sukra Helitek Inc.	Lead Organization	Industry Women-Owned Small Business (WOSB)	Ames, Iowa
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Iowa

Project Transitions

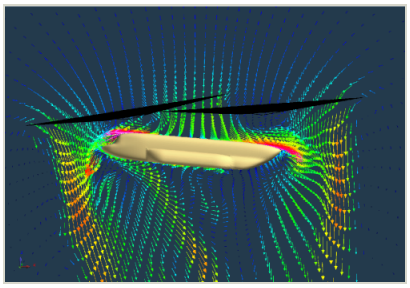
April 2012: Project Start

April 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138476)*

Images



Project Image
RotCFD: A Viscous Design Tool for Advanced Configurations Project Image
(https://techport.nasa.gov/image/128471)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Sukra Helitek Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
R Ganesh Rajagopalan

Co-Investigator:
Andrew Hollingsworth

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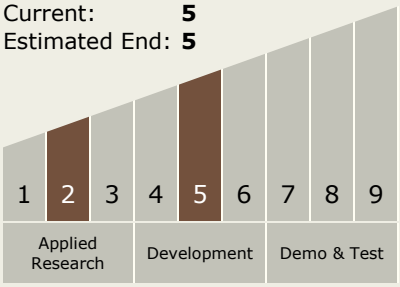
Completed Technology Project (2012 - 2014)

Technology Maturity (TRL)

Start: **2**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.8 Ground and Flight Test Technologies

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System